



# UNITED STATES PATENT AND TRADEMARK OFFICE

*K.H.*  
UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/955,111	09/19/2001	Satoshi Maemori	2001-1300A	9635
513	7590	04/21/2004	EXAMINER	
WENDEROTH, LIND & PONACK, L.L.P.			LEE, SIN J	
2033 K STREET N. W.			ART UNIT	
SUITE 800			PAPER NUMBER	
WASHINGTON, DC 20006-1021			1752	

DATE MAILED: 04/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/955,111	MAEMORI ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Sin J. Lee	1752	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 04 March 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

### DETAILED ACTION

1. In view of the amendment filed on March 4, 2004, the previous rejections on claims 1-17 under 35 U.S.C. 112 are hereby withdrawn. Also, in view of the amendment, the previous rejections on claims 1, 4, 5, and 10-17 over Kawabe et al (EP'489) and the previous rejections on claims 1, 3-5, 10, and 13-17 over Chen et al'321 in view of Kawabe et al (EP'489) are hereby withdrawn because Kawabe teaches the amount of the surfactant to be 50–2000 ppm based on the amount of their polymer.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 2, 4, 5, 10, 15, and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Fujie et al (6,303,264 B1).

Fujie et al teach (col.2, lines 13-21 and Example 1) a chemical amplified type positive working resist composition suitable *for use with KrF excimer laser* comprising a polymer capable of becoming alkali-soluble owing to the action of an acid such as *poly[p-(1-ethoxyethoxy)styrene/p-hydroxystyrene]* (in this polymer, the *1-ethoxyethyl group (an alkoxyalkyl group)* as in the 1-ethoxyethoxy moiety is an *acid-dissociable group*), a photoacid generator, and a solvent. Fujie furthermore teaches (col.20, lines

Art Unit: 1752

20-23, lines 59-61, col.21, lines 1-4) that surfactants such as fluorine-containing nonionic surfactants can be added in the amount of 0.001 to 10 parts by weight per 100 parts by weight of his polymer components. Since 0.001 part is included as the lower end of the taught range, one of ordinary skill in the art would immediately envisage using the surfactant in the amount of 0.001 parts by weight per 100 parts by weight of Fujie's polymer components, and this amount converts to *10 ppm by weight* ( $0.001 / 100 = 10^{-5} = 10 \text{ ppm}$ ) of the surfactant based on the amount of Fujie's polymer components.

Since the prior art teaches all of the present components of claim 1, the prior art's composition would inherently be suitable for the formation of a photoresist layer having a thickness in the range from 100 to 650 nm on the surface of a substrate as presently recited in claim 1. Therefore, Fujie teaches present inventions of claims 1, 2, 4, 5, and 10.

With respect to present claims 15 and 17, Fujie teaches (col.21, lines 33-37) that his resist composition is spin-coated onto a semiconductor substrate and baked on a hot plate to obtain a resist film of 0.5 - 2 um thickness, which converts to 500 nm to 2,000 nm thickness. Since 500 nm is included as the lower end of the taught range, one of ordinary skill in the art would immediately envisage forming Fujie's dried resist film to be 500 nm in thickness. Therefore, Fujie teaches present inventions of claims 15 and 17.

#### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 1752

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fujie et al (6,303,264 B1).

Fujie teaches (col.20, lines 24-51) that sensitivity adjustors such as trialkylamines (in Example 1, Fujie specifically uses tri-n-propylamine compound which is a tertiary aliphatic amine compound) can be added in the amount of 0.001 to 10 parts by weight per 100 parts by weight of their polymer components. Since this range overlaps with present range of 0.01 to 1 part by weight, the prior art's range would have made present range *prima facie* obvious. In the case "where the [claimed] ranges overlap or lie inside ranges disclosed by the prior art," a *prima facie* case of obviousness would exist which may be overcome by a showing of unexpected results, In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976). Therefore, Fujie's teaching would render obvious present invention of claim 13.

6. Claims 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujie et al (6,303,264 B1) in view of Urano et al (JP 05-194472 and its machine-assisted English translation provided by Japan Patent Office).

Fujie et al is discussed above in Paragraph 3. In Example 1, Fujie's composition contains poly[p-(1-ethoxyethoxy)styrene/p-hydroxystyrene]. In Example 2, his composition contains poly(p-tert-butoxystyrene/p-hydroxystyrene), and in Example 3, his composition contains poly-(p-1-tetrahydropyranyloxystyrene/p-hydroxystyrene). However, the prior art does not specify what molar% of the acid dissociable groups

Art Unit: 1752

(such as 1-ethoxyethyl group, tert-butyl group and tetrahydropyranyl group) is substituting for the hydrogen atoms in the hydroxyl groups of hydroxystyrene. Fujie states in col.14, lines 8-12 that his polymer capable of becoming alkali-soluble can be obtained by the processes disclosed in JP 05-194472 (Urano et al). In the machine-assisted translation of the Japanese document (see [0022] and [0023]), it is indicated that poly(p-tert-butoxystyrene/p-hydroxystyrene) and poly-(p-1-tetrahydropyranyloxystyrene/p-hydroxystyrene) are synthesized, and in both of the instances, the acid-dissociable group (tert-butyl group and tetrahydropyranyl group) are being present in the amount of 10 molar %. It would have been obvious to one of ordinary skill in the art to make Fujie's polymer which are capable of becoming alkali-soluble (such as the ones shown in his Examples) such that the acid-dissociable group in each polymer would be present in the amount of 10 molar % because Fujie refers to JP 05-194472 for the synthesis of his polymers and because the Japanese document clearly teaches that the acid-dissociable groups are substituting for the hydrogen atoms in the hydroxyl groups of hydroxystyrene in the amount of 10 molar %. Therefore, Fujie in view of Urano would render obvious present invention of claim 6.

With respect to present claim 7, in Example 20 (see Table 8), Fujie uses combination of 4.5 g of poly[p-(1-ethoxyethoxy)styrene/p-hydroxystyrene] (Mw: 20,000 and dispersity: 1.85) and 1.5 g of poly[p-tert-butyloxycarbonyloxystyrene/p-hydroxystyrene] (Mw: 8,000 and dispersity: 1.85). As discussed above with respect to present claim 6, it would have been obvious to one of ordinary skill in the art to make Fujie's polymers in Example 20 such that the acid-dissociable groups in each polymer

would be present in the amount of 10 molar % because Fujie refers to JP 05-194472 for the synthesis of his polymers and because the Japanese document clearly teaches that the acid-dissociable groups are substituting for the hydrogen atoms in the hydroxyl groups of hydroxystyrene in the amount of 10 molar %. Therefore, Fujie in view of Urano would render obvious present invention of claim 7 (present ratio of (b1):(b2) for Fujie's polymers in his Example 20 would be 0.333 which lies between the present range of 10:30 (0.111) to 90:10 (9)).

With respect to present claim 9, in Example 19 (see Table 8), Fujie uses combination of 4.5 g of poly[p-(1-ethoxyethoxy)styrene/p-hydroxystyrene] (Mw: 20,000 and dispersity: 1.80) and 1.5 g of poly[p-tert-butoxystyrene/p-hydroxystyrene] (Mw: 8,000 and dispersity: 1.95). As discussed above with respect to present claim 6, it would have been obvious to one of ordinary skill in the art to make Fujie's polymers in Example 19 such that the acid-dissociable groups in each polymer would be present in the amount of 10 molar % because Fujie refers to JP 05-194472 for the synthesis of this polymer and because the Japanese document clearly teaches that the acid-dissociable groups are substituting for the hydrogen atoms in the hydroxyl groups of hydroxystyrene in the amount of 10 molar %. Therefore, Fujie in view of Urano would render obvious present invention of claim 9 (present ratio of (b1):(b2) for Fujie's polymers in his Example 19 would be 0.333 which lies between present range of 19:90 (0.111) to 90:10 (9)).

With respect to present claim 8, as explained above, in his Example 19, Fujie uses combination of 4.5 g of poly[p-(1-ethoxyethoxy)styrene/p-hydroxystyrene] (Mw:

Art Unit: 1752

20,000 and dispersity: 1.80) and 1.5 g of poly[p-tert-butoxystyrene/p-hydroxystyrene] (Mw: 8,000 and dispersity: 1.95). Fujie also teaches the equivalence of poly[p-tert-butoxystyrene/p-hydroxystyrene] and poly[p-tetrahydropyranyloxystyrene/p-hydroxystyrene] in col.11, lines 24-44. Because the prior art teaches the equivalence of these two polymers, it would have been obvious to one of ordinary skill in the art to replace the poly[p-tert-butoxystyrene/p-hydroxystyrene] in Fujie's Example 19 with the poly[p-tetrahydropyranyloxystyrene/p-hydroxystyrene] and use the combination of 4.5 g of poly[p-ethoxyethoxy)styrene/p-hydroxystyrene] (Mw: 20,000 and dispersity: 1.80) and 1.5 g of poly[p-tetrahydropyranyloxystyrene/p-hydroxystyrene] (Mw: 8,000 and dispersity: 1.95) in the Example 19. As discussed above with respect to present claim 6, it would have been obvious to one of ordinary skill in the art to make Fujie's polymers in Example 19 such that the acid-dissociable groups in each polymer would be present in the amount of 10 molar % because Fujie refers to JP 05-194472 for the synthesis of this polymer and because the Japanese document clearly teaches that the acid-dissociable groups are substituting for the hydrogen atoms in the hydroxyl groups of hydroxystyrene in the amount of 10 molar %. Therefore, Fujie in view of Urano would render obvious present invention of claim 8 (present ratio of (b1):(b2) for Fujie's polymers in his Example 19 would be 0.333 which lies between present range of 19:90 (0.111) to 90:10 (9)).

7. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fujie et al (6,303,264 B1) as applied to claim 15 above, and further in view of Padmanaban et al (6,329,117 B1).



Fujie et al with respect to present claim 15 is discussed above in Paragraph 3. Fujie does not teach present antireflection coating film of claim 16. Padmanaban (see col.3, lines 52-56 and col.11, lines 55-67) teaches providing an anti-reflective coating film between a substrate and a positive working chemically amplified deep UV photoresist composition layer in order to reduce problems associated with reflected light from the substrate and topography during pattern formation. Padmanaban teaches forming such anti-reflective coating film having thickness of 60 nm on a silicon wafer. Based on Padmanaban's teaching, it would have been obvious to one of ordinary skill in the art to provide an anti-reflective coating film having thickness of 60 nm between Fujie's semiconductor substrate and his photoresist composition layer with a reasonable expectation of reducing problems associated with reflected light from the substrate and topography during pattern formation as taught by Padmanaban et al. Therefore, Fujie in view of Padmanaban would render obvious present invention of claim 16.

8. Claims 1, 3-5, 10, 13, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,365,321 B1) in view of Fujie et al (6,303,264 B1).

Chen et al teach a photoresist binder composition comprising a homogeneous blend of (i) a hydroxystyrene copolymer comprising a first monomer that is substituted or unsubstituted hydroxystyrene and a second monomer containing a photoacid-cleavable alicyclic ester group, and (ii) a phenolic polymer, wherein the phenolic polymer is selected from the group consisting of polyhydroxystyrene, poly(hydroxystyrene-co-styrene), *poly(hydroxystyrene-co-styrene-co-t-butyl acrylate)*, novolac, and combinations thereof. See claims 1 and 10. Since there are only four

Art Unit: 1752

examples given for the phenolic polymer component, it is the Examiner's position that one of ordinary skill in the art would immediately envisage poly(hydroxystyrene-co-styrene-co-*t*-butyl acrylate) to be the phenolic polymer component in Chen's invention. Since Chen's poly(hydroxystyrene-co-styrene-co-*t*-butyl acrylate) contains the *t*-butyl acrylate repeating unit, the prior art's phenolic polymer contains an acid-dissociable group (*tert*-butyl group) and is capable of being imparted with increased solubility in an aqueous alkaline solution by interaction with an acid.

Chen's lithographic resist composition additionally comprises a radiation-sensitive acid generator which generates an acid upon exposure to radiation such as *KrF excimer*. See col.2, lines 30-33, col.10, and lines 44-48.

Although Chen teaches (col.9, lines 51-53) that surfactants may be used in his composition to improve coating uniformity, the prior art does not explicitly teach the amount of the surfactants to be used. Fujie et al, a reference which also teaches a chemically amplified positive resist composition, teaches (col.20, lines 61-67, col.21, lines 1-4) that surfactants preferably used to aid formation of a resist film are fluorine-containing nonionic surfactants and that the amount of the surfactants is preferably 0.001 to 10 parts by weight per 100 parts by weight of the polymer components. Since 0.001 part is included as the lower end of the taught range, it would have been obvious to one of ordinary skill in the art to use the fluorine-containing nonionic surfactant in Chen's invention in the amount of 0.001 parts by weight per 100 parts by weight of Chen's polymeric binder (this amount converts to *10 ppm by weight* ( $0.001 / 100 = 10^{-5} = 10 \text{ ppm}$ ) of the surfactant based on the amount of Chen's polymeric binder) with a

Art Unit: 1752

reasonable expectation of aiding formation of Chen's resist film as taught by Fujie.

Therefore, Chen in view of Fujie would render obvious present inventions of claims 1, 3-5, and 10 (since Chen in view of Fujie teach all of the claimed components for the present chemical-amplification positive-working photoresist composition of claim 1, it is the Examiner's position that the composition taught by Chen in view of Fujie would inherently be suitable for the formation of a photoresist layer having a thickness in the range of 100-650 nm on the surface of a substrate as presently recited in claim 1; *besides*, Chen states in col.10, lines 42-44 that his dried resist film has a thickness of 0.1-5.0 microns (which is equal to 100-5000 nm)).

With respect to present claim 13, although Chen teaches (col.9, lines 35-38) the use of nitrogenous compounds (such as tertiary amines) as stabilizers and acid-diffusion controlling additive (thus, Chen is using the nitrogenous compounds for the purpose that is the same as that of present invention – see pg.9, [0029] of present specification), the prior art does not explicitly teach the amount of such compounds to be used. However, the present range of claim 13 would have been obvious to one of ordinary skill in the art at the time the invention was made because it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Therefore, Chen in view of Fujie would render obvious present invention of claim 13.

With respect to present claim 15, Chen teaches (col.10, lines 21-44) coating a substrate with a film comprising their lithographic resist composition, and the prior art furthermore teaches the thickness of the dried film made of their lithographic resist

composition to be 0.1-5.0 microns, which converts to 100-5000 nm. Since 0.1 microns (100 nm) is included as the lower end of the taught range, one of ordinary skill in the art would immediately envisage coating Chen's resist composition onto a substrate such that the thickness of the dried film made of the resist composition would be 0.1 micron (100 nm). Therefore, Chen in view of Fujie would render obvious present invention of claim 15.

With respect to present claim 17, since Chen's range of 100-5000 nm for the thickness of the dried resist film overlaps with present range of 300-570 nm, the prior art's range would have made present range *prima facie* obvious. See In re Wertheim, *supra*. Therefore, Chen in view of Fujie would render obvious present invention of claim 17.

9. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,365,321 B1) in view of Fujie et al (6,303,264 B1) as applied to claim 1 above, and further in view of Sato et al (5,948,589).

Chen et al in view of Fujie et al is discussed above in Paragraph 8. Chen et al in view of Fujie et al do not teach the use of presently claimed carboxylic acid compound of claim 14. However, it is well known in the art, as evidenced by Sato et al, col.7, lines 54-61, to use a carboxylic acid compound in a positive working photoresist composition to prevent an undue decrease in the photosensitivity of the composition due to the presence of an amine compound, and also to increase the pattern resolution along with an improving effect in the adaptability of the resist composition to various kinds of substrates to give a satisfactory patterned resist layer. Sato teaches the amount of the

Art Unit: 1752

carboxylic acid to be 0.01 to 5 wt% based on the amount of a resinous compound having acid-decomposable group. Since 0.01 wt% is included as the lower end of a taught range, it would have been obvious to one of ordinary skill in the art to use a carboxylic acid compound in Chen's composition in the amount of 0.01 wt% based on the amount of Chen's resin binder with a reasonable expectation of preventing an undue decrease in the photosensitivity of the composition due to the presence of an amine compound and also to increase the pattern resolution along with an improving effect in the adaptability of the resist composition to various kinds of substrates to give a satisfactory patterned resist layer as taught by Sato et al. Therefore, Sato teaches the present amount of the carboxylic acid (0.01 – 1 part by weight of the carboxylic acid compound per 100 parts by weight of the resinous compound which converts to 0.01 to 1 wt% of the carboxylic acid compound based on the resinous compound), and Chen in view of Fujie, and further in view of Sato would render obvious present invention of claim 14.

10. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al (6,365,321 B1) in view of Fujie et al (6,303,264 B1) as applied to claim 15 above, and further in view of Padmanaban et al (6,329,117 B1).

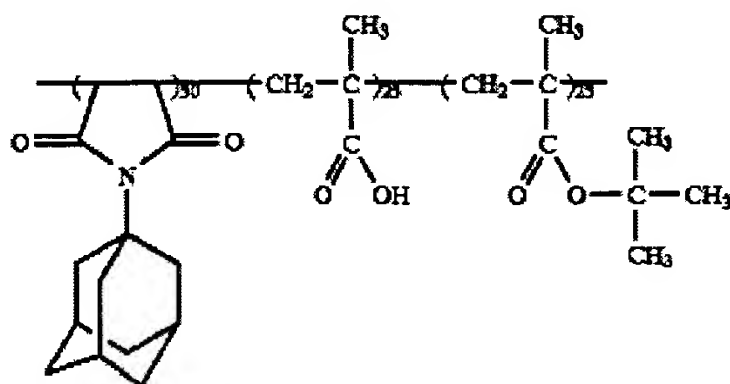
Chen et al in view of Fujie et al with respect to present claim 15 is discussed above in Paragraph 8. Chen teaches coating his resist composition on a silicon wafer treated with an organic anti-reflective coating (see col.13, lines 21-22), but without giving the thickness for the organic anti-reflective coating. Padmanaban (see col.3, lines 52-56 and col.11, lines 55-67) teaches providing an anti-reflective coating film

Art Unit: 1752

between a substrate and a positive working chemically amplified deep UV photoresist composition layer in order to reduce problems associated with reflected light from the substrate and topography during pattern formation. Padmanaban teaches forming such anti-reflective coating film having thickness of 60 nm on a silicon wafer. Based on Padmanaban's teaching, it would have been obvious to one of ordinary skill in the art to provide an anti-reflective coating film having thickness of 60 nm between Chen's silicon wafer and Chen's photoresist composition layer with a reasonable expectation of reducing problems associated with reflected light from the substrate and topography during pattern formation as taught by Padmanaban et al. Therefore, Chen in view of Fujie, and further in view of Padmanaban would render obvious present invention of claim 16.

11. Claims 1, 4, 5, 10-13, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ushirogouchi et al (5,932,391) in view of Fujie et al ((6,303,264 B1).

In Example 19, Ushirogouchi teaches (see col.8, lines 38-44, Table 3 in col.37, col.34, lines 17-30) a chemically amplified positive type resist composition containing a polymer which is shown below



and a photoacid generator. The polymer shown above contains a t-butyl group (a tertiary alkyl group) which is the present acid dissociable group of present claims 4 and 5, and thus Ushirogouchi teaches present resinous compound of claim 1 having acid-dissociable groups and capable of being imparted with increased solubility in an aqueous alkaline solution by interaction with an acid. Ushirogouchi coats his resist composition on a silicon wafer to a thickness of 0.6  $\mu\text{m}$  (which is equal to 600 nm), and then the resist film is imagewise exposed to *ArF excimer laser* beam and developed to remove the exposed portion of the resist film, thus forming a positive resist pattern (see col.38, lines 14-26).

Ushirogouchi also teaches (col.29, lines 14-23) that his composition can contain a surfactant for modifying a coated film, but without specifying the amount of the surfactant to be used. Fujie et al, a reference which also teaches a chemically amplified positive resist composition, teaches (col.20, lines 61-67, col.21, lines 1-4) that surfactants preferably used to aid formation of a resist film are fluorine-containing nonionic surfactants and that the amount of the surfactants is preferably 0.001 to 10 parts by weight per 100 parts by weight of the polymer components. Since 0.001 part is included as the lower end of the taught range, it would have been obvious to one of ordinary skill in the art to use a fluorine-containing nonionic surfactant in Ushirogouchi's invention in the amount of 0.001 parts by weight per 100 parts by weight of Ushirogouchi's polymer (this amount converts to 10 ppm by weight ( $0.001 / 100 = 10^{-5} = 10 \text{ ppm}$ ) of the surfactant based on the amount of Ushirogouchi's polymer) with a reasonable expectation of aiding formation of Ushirogouchi's resist film as taught by

Fujie. Therefore, Ushirogouchi in view of Fujie would render obvious present inventions of claims 1, 4, 5, 11, 12, and 15.

With respect to present claim 10, since Ushirogouchi states (col.29, lines 66-67, col.30, lines 1-8) that his resist composition can be used with a deep UV beam such as KrF or ArF excimer laser beam, it is the Examiner's position that Ushirogouchi's photoacid generator is capable of generating an acid by the irradiation with KrF excimer laser beam as presently recited in claim 10. Therefore, Ushirogouchi in view of Fujie would render obvious present invention of claim 10.

With respect to present claim 13, Ushirogouchi does not teach the use of a tertiary aliphatic amine compound in his invention. However, it well known in the art, as evidenced by Fujie (col.20, lines 24-51), to use a tertiary aliphatic amine compound (for example, tri-n-propylamine) as a sensitivity adjustor in a chemically amplified positive type resist composition. Fujie teaches the use of the sensitivity adjustor in the amount of 0.001 to 10 parts by weight per 100 parts by weight of their polymer components. Therefore, it would have been obvious to one of ordinary skill in the art to use a tertiary aliphatic amine compound such as tri-n-propylamine in the amount of 0.001 to 10 parts by weight per 100 parts by weight of the polymer component in Ushirogouchi's invention in order to be able to adjust sensitivity of the composition. Since the range taught by Fujie overlaps with present range of 0.01 to 1 part by weight, the prior art's range would have made present range *prima facie* obvious. See In re Wertheim, supra. Therefore, Ushirogouchi in view of Fujie would render obvious present invention of claim 13.



With respect to present claim 17, as discussed above, Ushirogouchi coats his resist composition on a silicon wafer to a thickness of 600 nm. Since this value is close to the higher end of the present range (300-570 nm), it is the Examiner's position that the prior art's thickness value would have made present thickness range *prima facie* obvious. Where the claimed ranges and prior art do not overlap but are close enough that one skilled in the art would have expected them to have the same properties, a *prima facie* case of obviousness would exist which may be overcome by a showing of unexpected results, In re Titanium Metals Corporation of America v. Banner, 227 USPQ 773 (Fed. Cir. 1985). Therefore Ushirogouchi in view of Fujie would render obvious present invention of claim 17.

12. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ushirogouchi et al (5,932,391) in view of Fujie et al (6,303,264 B1) as applied to claim 1 above, and further in view of Sato et al (5,948,589).

Ushirogouchi et al in view of Fujie et al with respect to present claim 1 is discussed above in Paragraph 11. Ushirogouchi et al in view of Fujie et al do not teach the use of presently claimed carboxylic acid compound of claim 14. However, it is well known in the art, as evidenced by Sato et al, col.7, lines 54-61, to use a carboxylic acid compound in a positive working photoresist composition to prevent an undue decrease in the photosensitivity of the composition due to the presence of an amine compound, and also to increase the pattern resolution along with an improving effect in the adaptability of the resist composition to various kinds of substrates to give a satisfactory patterned resist layer. Sato teaches the amount of the carboxylic acid to be 0.01 to 5

wt% based on the amount of a resinous compound having acid-decomposable group. Since 0.01 wt% is included as the lower end of a taught range, it would have been obvious to one of ordinary skill in the art to use a carboxylic acid compound in Ushirogouchi's composition in the amount of 0.01 wt% based on the amount of his polymer component with a reasonable expectation of preventing an undue decrease in the photosensitivity of the composition due to the presence of an amine compound and also to increase the pattern resolution along with an improving effect in the adaptability of the resist composition to various kinds of substrates to give a satisfactory patterned resist layer as taught by Sato et al. Therefore, Sato teaches the present amount of the carboxylic acid (0.01 – 1 part by weight of the carboxylic acid compound per 100 parts by weight of the resinous compound which converts to 0.01 to 1 wt% of the carboxylic acid compound based on the resinous compound), and Ushirogouchi in view of Fujie, and further in view of Sato would render obvious present invention of claim 14.

13. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ushirogouchi et al (5,932,391) in view of Fujie et al (6,303,264 B1) as applied to claim 15 above, and further in view of Padmanaban et al (6,329,117 B1).

Ushirogouchi et al in view of Fujie et al with respect to present claim 15 is discussed above in Paragraph 11. Ushirogouchi in view of Fujie do not teach presently claimed antireflection coating film of present claim 16. However, it is well known in the art, as evidenced by Padmanaban, col.3, lines 52-56 and col.11, lines 55-67, to provide an anti-reflective coating film between a substrate and a positive working chemically amplified deep UV photoresist composition layer in order to reduce problems associated

with reflected light from the substrate and topography during pattern formation.

Padmanaban teaches forming such anti-reflective coating film having thickness of 60 nm on a silicon wafer. Based on Padmanaban's teaching, it would have been obvious to one of ordinary skill in the art to provide an anti-reflective coating film having thickness of 60 nm between Ushirogouchi's silicon wafer and his photoresist composition layer with a reasonable expectation of reducing problems associated with reflected light from the substrate and topography during pattern formation as taught by Padmanaban et al. Therefore, Ushirogouchi in view of Fujie, and further in view of Padmanaban would render obvious present invention of claim 16.

14. It is to be noted that although Sato et al'589 teaches the use of a carboxylic acid compound in a positive working photoresist composition as discussed above, the reference was not combined with Fujie et al'264 to reject present claim 14 because Fujie et al discourages such use of a carboxylic acid compound (see col.21, lines 53-67, col.1, lines 45-59).

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is 571-272-1333. The examiner can normally be reached on Monday-Friday from 9:00 am EST to 5:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F. Huff, can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1752

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*S. J. Lee*

S. Lee  
April 17, 2004

*Sin J. Lee*  
Sin J. Lee  
Patent Examiner  
Technology Center 1700